特 別 掲 載

Radioactive Phosphorus in the Differential Diagnosis of the Malignant Lymphoma and Tuberculous Lymphadenitis

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放射性同位元素（^{32}P）による悪性リンパ腺腫と結核性リンパ腺腫の鑑別診断

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頸部リンパ肉腫及び細網肉腫と，頸部結核性リンパ腺腫との鑑別診断の目的で，放射性同位元素（^{32}P）の静注後ガイガー計数管による皮膚表面計測を行ない，^{32}P の表面計測可能なほど皮膚の薄い患者では鑑別診断に役立つことを認めた．すなわち，悪性リンパ腺腫の表面では ^{32}P 投与後2週間にわたり対照側の 1.3～ 1.5倍の計測値を得たが，結核性リンパ腺腫の表面では，投与後1～2日間にわたり対照側の計測値よりやや高い値を得るに過ぎなかつた．

Introduction

The metabolic activity of malignant tumors is greatly increased compared with that of normal tissue, the increase being roughly proportional to the rate of their growth. This results in a greatly accelerated turnover and increased incorporation of radioactive phosphorus in malignant tumors. This fact has been utilized to localize malignant tumors by external counting of concentrations of radioactive phosphorus as a tracer. The differential diagnosis of benign lymphoma and malignant lymphoma has always been a difficult problem without a histological examination of their biopsy. This study was undertaken in our attempt to develope a simple clinical procedure whereby benign lymphoma could be differentiated from malignant lymphoma even before biopsy.

Method

300—500 μc of ^{32}P as phosphate were administered intravenously. This dose is rather larger than employed in most tracer test, but can be regarded as justified in patients in whom the presence of malignant lymphoma is suspected. There was no discernible hematological reactions following administration of this dose of ^{32}P.

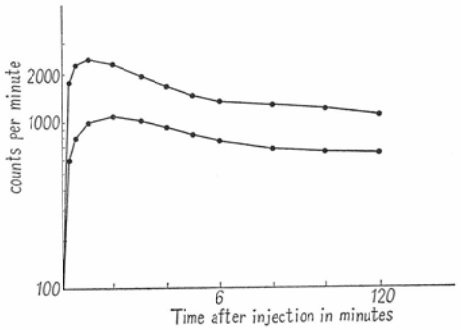
The lesion were counted with an end window Geiger-Muller tube. To count the radioactivity of a given region, the counter window was placed in direct contact with the skin over the lymphoma. Since the absolute counting rate varied from patient to patient even after comparative doses, the counting rate over the lymphoma were compared in each patient with the counting rates for comparable normal area in the same patient. The symmetrical normal area show essentially equal counts within a few percent. Variation between non-symmetrical areas are much gerater. The readings over the

lymphoma were alternat ed with readings over the normal contralateral area. The activity on the lymphnodes was measured in successive hours and days.

For studying of surface activity over the lymphoma, patients were selected with obvious superficial lymphoma in cervical region.

Result

In Fig. 1 are shown the counting rate over the normal skin, counts per minute being plotted against time after intravenous administration of ^{32}P. The counting rate at the skin increased rapidly to a maximum value within about twenty minutes, decreased fairly rapidly for an hour or two, and at a relatively



Fsg. 1 Counting rate over normal area during first two hours after intravenous injection of ^{32}P

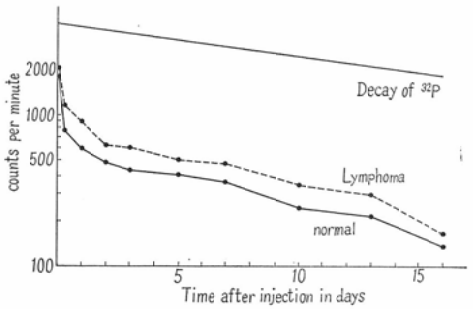


Fig. 2 Pt. T.O. Age 39 Lymphosarcoma

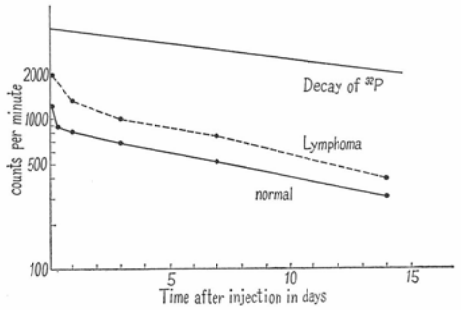


Fig. 3 Pt. S.M. Age28 Lymphosarcoma

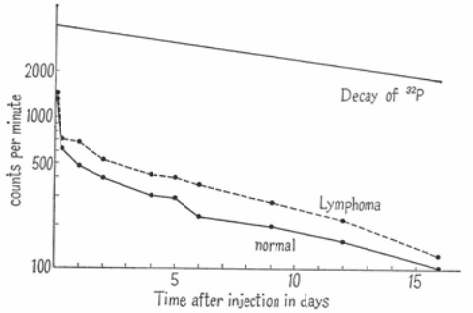


Fig. 4 Pt. T.K. Age 46 Reticulosarcoma

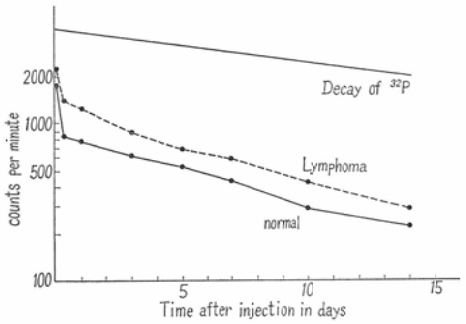


Fig. 5 Pt. T.K. Age 35 Reticulosarcoma

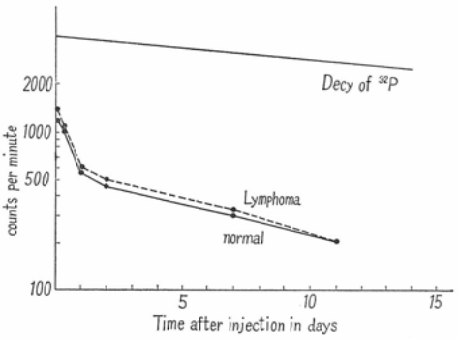


Fig. 6 Pt. Y.S. Age14 Lymphadenitis colli tuberculosa

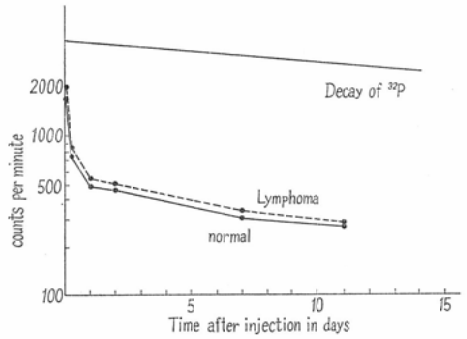


Fig. 7 Pt. M.Y. Age9 Lymphadenites colli tuberculosa

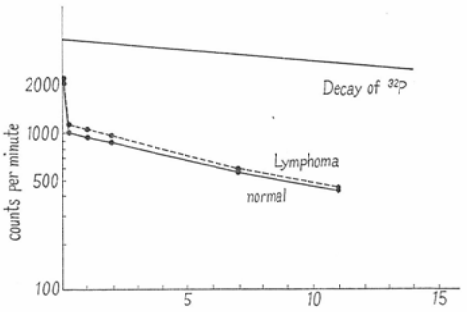


Fig. 8 Pt. K.F. Age17 Lymphadenitis colli tuberculosa Time after injectionin days

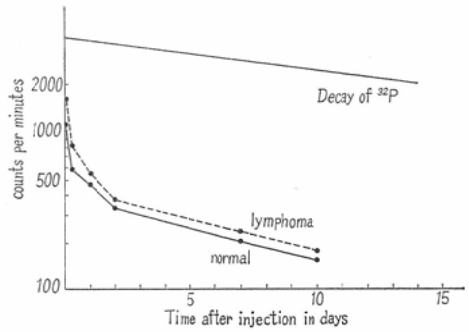


Fig. 9 Pt. H.A. Age 14 Lymphadenitis colli tuberculosa

Table 1 Counting ratio (lymphoma/normal) over the maligant and tuberculous lymphoma.

Diagnosis	case	1 hr.	3 hr.	24 hr.	2— 3 day	5— 7 day	10—14 day
Lymphsarcoma	T. O. ♂39	1.1	1.5	1.5	1.4	1.3	1.4
	S. M. ♂28	1.6	1.9	1.6	1.5	1.5	1.3
Reticulosarcoma	T. K. ♂46	1.1	1.1	1.4	1.3	1.5	1.4
	M. O. ♂35	1.3	1.7	1.6	1.4	1.3	1.5
Lymphadenitis tuberculosa	Y. S. ♀14	1.2	1.0	1.0	1.1	1.0	
	M. Y. ♂ 9	1.2	1.1	1.1	1.1	1.0	
	K. F. ♀17	1.0	1.1	1.1	1.0	1.0	
	H. A. ♀14	1.4	1.7	1.1	1.1	1.1	

constant rate thereafter. In Fig. 2–9 are shown the counting rates over the lymphoma and comparabel normal area of the opposite side in successive days after administration. The decrease in counting rate after the first 3–48 hours appears as a straight line on this graph, though of greater slope than the line representing radioactive decay of ^{32}P. The increase in slope is due to metabolic elimination of the ^{32}P. Since this observed rate of decrease is represented by a straight line, it is exponential function of the time.

In Table 1 are shown the ratio of the counting rate for the lymphoma to the counting rate for the comparable normal area. Counting rate over the superficial lymphsarcoma or reticulosarcoma was 1.3 to 1.5 times that in normal comparable area for 2 weeks. Counting rate over the tuberculous lymphoma appeared only a little higher than the control area for first 1–2 days, and thereafter appeared not to be outside the normal range.

Discussion

Low-Bear[10)12)] et al were the first to demonstrate tha many malignant breast tumors could be differentiated from benign lesions. Similarly, ^{32}P measurement was used in the diagnosis of eye tumors[7)9)], testicular tumors[14)], skin tumors[2)6)11)], urerine cervix cancer[4)5)], vulvar cancer[3)], cancer of digestive tract[1)13)] and brain tumors[15)16)].

However, the disadvantage of ^{32}P is the fact that its most energetic beta particles penetrate only about 8 mm in tissue. This makes external counting of lesions beneath the thick layer of skin difficult. In our present study the slender patient was selected, whose skin was thin enough to count the beta activity beneath the skin. The turnover of phosphate, an integral part of the nucleic acid, is increased in malignant tumor. Rapidly growing tumor such as lymphosarcoma or reticulosarcoma takes greater amount of radioactive phosphorus[8)] than relatively slow growing tumor. In our present experiment the absorption of the energy by the overlying skin may decrease the surface activity over the malignant lymphoma. The granulation tissue such as tuberculous lymphadenitis also gave a little higher count than corresponding normal skin, presumably due to extravasation of radioactive phosphorus containing serum, and the increased ^{32}P content of granulation tissue. In our selected patients the difference of surface activity between the benign and malignant lymphoma was found. Consequently, we feel that, with the simple technique described in this paper, valuable information can be gained in the differentiation of malignant lymphoma from tuberculous lymphoma.

Summary

1) Eight selected patients with malignant and tuberculous lymphoma were studied, by means of an end-window Geiger-Muller counter for beta particle surface activity following intravenous administration of ^{32}P.

2) Surface activity on normal skin appeared at once, reached maximum between few and twenty minutes after intravenous administration, and decreased approximately exponentially after 1–2 days.

3) Surface activity over the superficial lymphsarcoma and reticulosarcoma at the neck was 1.3–1.5 times that in normal comparable area as long as 2 weeks.

4) Counting rate over the tuberculous lymphoma appeared only a little higher than the control area for first 1–2 days, and thereafter appeared not outside the normal range.

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